

## SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

## No. XII.

1.—ON THE SQUIRRELS OBTAINED BY MESSRS. SHORTRIDGE AND  
MACMILLAN ON THE CHINDWIN RIVER, UPPER BURMA.*(With a coloured plate and map.)*

BY OLDFIELD THOMAS and R. C. WROUGHTON.

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The collection of Squirrels obtained on the Chindwin by the Society's collectors for the Mammal Survey, G. C. Shortridge and the late Capt. S. A. Macmillan, forms the most wonderful series that has ever come to the National Museum from any one district. It was known already from certain of the striking forms described by Thomas that the squirrels of this region would particularly repay investigation, and special efforts were therefore made by the collectors to form really complete series from as many stations as possible.

Thanks to favourable conditions and the ready help afforded them by officials of all classes, Messrs. Shortridge and Macmillan's expedition was most successful and especially so in regard to squirrels, of which just on 400 specimens were obtained, illustrating thoroughly the squirrel life of both sides of the river from Yin in  $22^{\circ} 50' N$ . Latitude up to Hkamti  $26^{\circ} 5'$ , near the source of the river, a distance of about 250 miles.

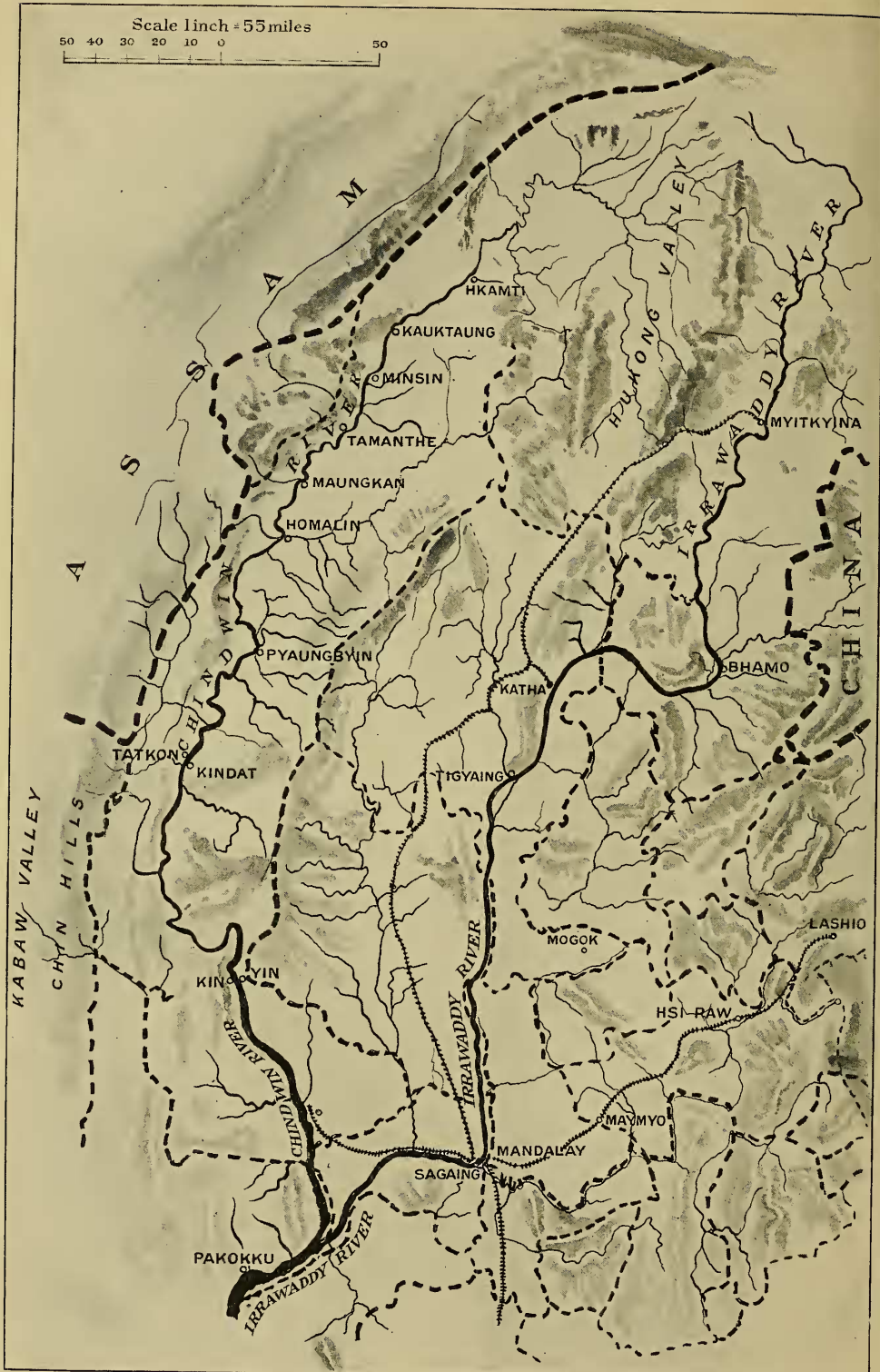
Knowing the problems involved, Mr. Shortridge was able to make the series thoroughly illustrative of the subject, so that we have never had to leave a question unsettled for want of material, at least so far as the Chindwin valley is concerned. The relation of this river to the Irrawaddy to the East, and to Manipur on the West, must, of course, await similar collections from those localities.

One flaw only exists in the series, and for this the collectors are not responsible. Namely that it is all made at one season of the year, and therefore that matters arising from seasonal change cannot now be dealt with.

For this reason especially we wish to urge local residents or visitors not to think that the subject is exhausted, as specimens killed at different dates are still wanted from all localities.

So far as we have been able to make out, the collection, which belongs to the genera *Ratufa*, \**Callosciurus*, \**Tomeutes*, *Tamiops* and *Dremomys* and is exclusive of Flying Squirrels, includes

\* For the substitution of these two Generic names for the old name *Sciurus* see Thomas' paper Ann. Mag. N. H. (8) xv. p. 383, 1915.



KEY MAP TO DISTRIBUTION OF SLADEN'S SQUIRREL IN THE RIVER BASINS OF THE CHINDWIN AND IRRAWADDY, UPPER BURMA.

21 species and subspecies, of which we have had occasion to describe no less than 11 as new, besides two from other sources. For this really splendid result Science has to thank the efforts of the Bombay Natural History Society, to whom also the National Collection is indebted for the donation of so complete a series of the specimens as fully to illustrate the conclusions we have come to. And in this invaluable donation there are included all the types of the new forms described.

Taking the collection of squirrels as a whole, one of its most striking features is its indication of the sharp line of demarcation which the River Chindwin forms to the eastward or westward extension of the different species. With the exception of *Ratufa gigantea*, occurring near the source, where it may have spread round, and a small and perhaps native—caused irruption of *Tomeutes lokroides* across the river at Homalin, no species or subspecies occurs on both banks of the river. Indeed the species on the two sides are generally referable to different groups, thus indicating that the separation has been of long standing, long enough for the groups on each bank to have respectively evolved within themselves the rich series of subspecies found in succession from North to South.

The following table indicates the different species and subspecies as they occur down the two sides of the river:—

	WEST BANK.		EAST BANK.
Hkamti ..	<i>Ratufa gigantea</i> ..		<i>Ratufa gigantea</i> .
N. Lat. 26° 5'.	<i>Callosciurus erythræus cro-</i>		<i>Callosciurus sladeni shortridgei</i> .
	<i>talius</i> .		
	<i>Tomeutes lokroides</i> ..		<i>Tomeutes similis owensi</i> .
			<i>Dremomys rufigenis opimus</i> .
			<i>Tamioops maclellandii</i> .
Kauktaung ..	.....		<i>C. sladeni shortridgei-fryanus</i> .
			<i>T. similis owensi</i> .
Minsin ..	.....		<i>C. sladeni fryanus</i> .
			<i>T. similis owensi</i> .
Tamanthe ..	<i>C. erythræus nagarum</i> ..		<i>C. sladeni careyi</i> .
	<i>T. lokroides</i> ..		<i>T. maclellandii</i> .
Maungkan ..	.....		<i>R. gigantea</i> .
			<i>C. sladeni haringtoni</i> .
			<i>T. maclellandii</i> .
Homalin ..	<i>C. erythræus nagarum</i> ..		<i>C. sladeni haringtoni</i> .
	<i>T. lokroides</i> ..		<i>T. lokroides</i> .
			<i>T. maclellandii</i> .
Pyauingbyin ..	.....		<i>C. sladeni millardi</i> .
Tatkon (W)—	<i>R. gigantea lutrina</i> ..		<i>C. sladeni sladeni</i> .
Kindat (E).	<i>C. erythræus kinneari</i> ..		<i>D. rufigenis adamsoni</i> .
	<i>T. lokroides</i> ..		.....
	<i>Dremomys macmillani</i> ..		.....
Kin (W)—	<i>T. lokroides nearsi</i> ..		<i>Ratufa fellii</i> .
Yin (E).			<i>C. sladeni rubex</i> .
			<i>C. pygerythrus janetta</i> .

*Tamiops* was also obtained to the West of the river, but not at any riverside station—only farther back among the hills.

*Ratufa gigantea*, McCl.

Seven from Hkamti, both East and West banks, and one from Maungkan, East bank.

Just at Hkamti, comparatively near the source, the same form is found on both banks of the Chindwin, but lower down, as with other squirrels, the river makes a sharp dividing line between different species and subspecies. On the East bank *R. gigantea* does not range below Maungkan, but on the West at Tatkon opposite Kindat, it is represented by a special subspecies.

*Ratufa gigantea lutrina*, subsp. n.

Essentially like true *gigantea*, but paler in both phases of the pelage. Unworn fresh fur chocolate-brown, or otter-colour, instead of black. Worn pelage bleaching to pale brown, or whitey-brown, commonly near "tawny-olive," much paler than the corresponding pelage of true *gigantea*. Tail with the hairs of its tip much lighter than the rest, often nearly white; the tail-end of *gigantea* is quite concolorous with the rest.

Dimensions of the type:—Head and body, 397 mm.; tail, 520; hindfoot, 84; ear, 32.

Skull:—Length, 77.

*Habitat*.—Lower parts of Upper Chindwin, on West bank. Type from Tatkon, opposite Kindat. Alt. 250'.

*Type*.—Adult female. B. M. No. 15. 5. 52. Original number 5622. Collected 5th July 1914. Five specimens from Tatkon, one from Sadwin, and three native skins from the Kabaw Valley, 300'.

We have as yet no knowledge of what *Ratufa* occurs in Manipur, but it will very probably be this subspecies, which is characterized by its paler colour and light tail-tip. Nor is any member of the genus found on the West bank lower down the Chindwin than this.

*Ratufa fellii*, sp. n.

Similar to *R. phaeopepla* in general characters, that is to say in the arrangement and distribution of the dark upper and buffy lower colour, including the wash of buffy half across the forearms, but while the head and limbs are black above as in that species, the middle of the body, from the withers to the rump, is greyish brown (between natal-brown and buffy-brown) in fresh pelage. The old pelage, which is present on the posterior back of every adult specimen, is dirty-whitish or straw colour, contrasting strikingly with the dark-brown or black of the foreback, and quite different from the

dull brown of the old bleached fur of *R. phaeopepla*. Tail-hairs mixed brown and black, except in the young specimens, in which they are black tipped with rufous.

Dimensions of the type:—Head and body, 365 mm.; tail, 435; hindfoot, 77; ear, 28. Skull:—Greatest length, 72; condylo-incisive length, 64; upper tooth series, 13·7.

*Habitat*.—Yin, East bank of Lower Chindwin. Alt. 250'.

*Type*.—Adult male. B. M. No. 15. 5. 5·55. Original number 5379. Collected 13th June 1914. Twenty-one specimens.

This *Ratufa* is readily distinguishable from *R. phaeopepla* and *melanopepla*, with which alone it needs comparison, by the much lighter colour of the trunk, and by the bleaching nearly to white of the old fur before replacement. Owing to the accident that all the adult specimens obtained during the Survey expedition were taken when half or more of the back was in this bleached condition, the difference is made to appear rather more striking to the eye than would be the case if two round-the-year series were compared with each other. But there is no doubt that the animal should be distinguished specifically, all the more that Mr. Shortridge tells us that no *Ratufas* occur between this and Mt. Popa, the nearest locality of *R. phaeopepla*. Moreover the skull agrees in size with that of true *melanopepla* of the Malay Peninsula, and not with that of the large Burmese *R. p. marana*.

We have named this fine animal in honour of Mr. G. B. H. Fell, C.I.E., I.C.S., to whom Mr. Shortridge has been immensely indebted for help of all kinds throughout his stay in Burma.

*R. fellii* would seem to have a very restricted range, as it was only obtained at the one locality Yin.

While working out the Chindwin *Ratufas* we have again examined those from Mt. Popa in the light of Mr. Miller's paper on the *melanopepla* group, and find that they are most nearly allied to his *R. phaeopepla* of S. Tenasserim, but may be subspecifically distinguished as follows.

*Ratufa phaeopepla marana*, subsp. n.

Size as in *R. phaeopepla*, the skull markedly larger than in true *melanopepla* and other forms from the regions South of Tenasserim. Colour of body when in fresh pelage black, not brown as in *phaeopepla*.

Dimensions in flesh of the type:—Head and body, 390 mm.; tail, 470; hindfoot, 86; ear, 30. Skull:—Greatest length, 74·3; condylo-incisive length, 67·5; upper toothrow, 14·4.

*Habitat*.—Dry zone of Burma. Type from Mt. Popa.

*Type*.—Adult female. B. M. No. 14. 7. 19. 107. Original number 3,892. Collected 26th September 1913 by G. C. Shortridge. Presented by the Bombay Natural History Society.

Mr. Miller has shown that some members of this group are truly black, while others are only a deep chestnut brown. The form inhabiting Tenasserim as far north as Moulmein is of the latter colour, the British Museum possessing examples of it from Mergui, and Thongyah, near Kaukaryit. On the other hand the Popa specimens are quite black, when in unbleached pelage, and in this respect resemble *calenopepla* from Domel Island, Southern Mergui Archipelago, but the occurrence of the brown *phæopepla* on the mainland far north of Mergui indicates that the Popa form cannot be the same as that of Domel.

\*  
*Callosciurus erythraeus*, Pall.

Of the *erythraeus* group the Chindwin collection contains 63 specimens, all obtained on the West bank, the species apparently not occurring on the East bank of the river. There seem to be three subspecies represented among them, of which two are new, and the third is the same as an Assamese form which has been long known, but has not hitherto had a special name. We commence by describing the latter.

*Callosciurus erythraeus nagarum*, subsp. n.

Whole upper surface grizzled grey, the dorsal area more suffused with buffy. Undersurface rich maroon red. Hands and feet like back, darkening terminally to black. Tail grizzled like body for its basal three-fourths, the hairs ringed white and pale buffy, the terminal fourth gradually passing into deep black.

Dimensions of the type, measured on the skin:—Head and body (e) 230; tail, 235; hindfoot, 51. Skull:—54.5.

*Habitat*.—N. E. Assam, Manipur, and neighbouring parts of Upper Burma. Type from Sadiya, Assam.

*Type*.—Adult male. B. M. No. 85. 8. 1. 170. Collected April 1877. Presented by Allan O. Hume, C. B.

Distinguished by the simplicity of its coloration, without any of the special markings that are found in other forms of this variable group.

This subspecies is in part the "*Sciurus rufiventer*, Geoff. (?)" of Blyth's 1847 paper on Squirrels,\* and the "summer pelage" of *Sciurus erythraeus erythrogaster* of Bonhote.† It is, however, certainly not the true *rufiventer*, which is American; and with regard to *erythrogaster* we are convinced that, as Thomas stated in 1886‡ the two pelages described by Bonhote as those of summer and winter are really indicative of racial and not of seasonal difference. Bonhote's "winter pelage" is the true *erythrogaster* of Blyth.

Of this squirrel the Museum contains, besides the type and

\* J. A. S. B. XVI, p. 871.

† Ann. Mag. N. H. (7) vii, p. 163, 1901.

‡ P. Z. S. 1886, p. 61.

another from Assam, examples from Aimole and Machi, Manipur, also presented by Mr. Hume, and now the Shortridge-Macmillan collection includes six specimens from Tamanthe, one from Homalin, one from Nankakauk, Kabaw Valley, and two from Haingyan, Chin Hills. One of these last-named has a grey grizzled line down the centre of the belly, the other not.

*Callosciurus erythreus crotalius*, subsp. n.

Like *C. e. nagarum* but the tip of the tail with an admixture of white or yellowish hairs.

General colour above grizzled grey, more or less suffused with buffy ("dresden-brown" of Ridgeway). Shoulders, sides and hips clearer grey without the buffy suffusion. Hands and feet grizzled grey darkening terminally to black; the metapodials often with a slight extension of rufous trespassing over them from below. Whole of undersurface and inner side of limbs deep rich rufous. Tail for its basal three-fifths grizzled or indistinctly annulated with black and pale buffy, the subterminal fifth black, the tip with a variable number of white and pale yellowish hairs which may amount to enough to make a definite terminal light tassel, or may in a few cases be altogether absent, the tail end being then black; in the majority of specimens an intermediate condition occurs.

Dimensions of the type, measured in the flesh:—Head and body 245 mm.; tail, 228; hindfoot, 52; ear, 21. Skull:—Greatest length, 55.

*Habitat*.—Extreme Upper Chindwin. Type series from Hkamti.\* Alt. 500'. One specimen also from Hukong Valley, 20 miles North of Hkamti.

*Type*.—Adult male B. M. No. 15.5.5.69. Original number 5,969. Collected 7th August 1914 by G. C. Shortridge and S. A. Macmillan. Presented by the Bombay Natural History Society. Thirty-nine specimens.

*Callosciurus erythreus kinneari*, subsp. n.

Tail white with a black tip.

Colour of body and limbs as in the previous race, though on the average the back is rather less suffused with buffy, so that the general tone is near "light greyish olive" of Ridgeway. Tail for its basal inch or two grizzled grey like the body, then for five or six inches its hairs are creamy white, their extreme tips only black; finally the terminal tuft is deep black.

Dimensions of the type, measured in the flesh:—Head and body, 230 mm.; tail, 233; hindfoot, 57; ear, 22; weight, 11 $\frac{3}{4}$  oz. Skull:—Greatest length, 56.5.

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\* This is the Hkamti on the Chindwin, about 26.5 N., 95.55 E. There is another in Kachin, about 27.30 N., 27.30 E.

*Habitat*.—Southern part of Upper Chindwin, on West bank. Type series from Tatkon, opposite Kindat. Alt. 250'. One specimen also from Ahlaw, Kabaw Valley. Alt. 300'.

*Type*.—Adult male. B. M. No. 15.5.5.79. Original number 5,492. Collected 26th June 1914. Fourteen specimens.

In two specimens out of fourteen the whitening of the middle portion of the tail is less conspicuous, the white being overlaid with grey, but even in these there is more white present than in the allied forms.

This striking squirrel, which is readily distinguishable by the unique marking of its tail, we have named in honour of Mr. Norman B. Kinnear, the Curator of the Society's Museum in Bombay, to whose hearty co-operation much of the success of the Survey is due.

*Callosciurus sladeni*, Anderson.

It is among the members of the *C. sladeni* group that the most wonderful results have been attained by Messrs. Shortridge and Macmillan as they collected no less than 180 specimens belonging to seven distinguishable subspecies, all the way down from Hkamti in the North of Upper Chindwin to Yin in Lower Chindwin, these subspecies occurring in succession down the East bank of the river, to which this group is confined.

From what we already know, this *C. sladeni* group would appear to be spread all over the area between the Upper Irrawaddy and the Chindwin, but whether it extends to the East of the former partly remains to be seen, and partly depends on the value we assign to the characters distinguishing it from species beyond this area. For it is extraordinarily difficult to decide which forms should be reckoned as "species" and which as "subspecies," deeper and more essential characters being almost non-existent, while the colour-characters—locally constant and therefore demanding some form of technical name—show an almost unlimited degree of intergradation.

Already from the present series it is evident that the whitish forms referred to *C. haringtoni* intergrade with the greyish ones representing *C. sladeni*, so that we have no alternative but to consider the whole lot as one species with a considerable number of local subspecies. Thomas had already spoken of the essential relationship of the two forms to one another, and we are not now surprised to find that they intergrade.

It is curious to note that while there is a considerable local constancy in general colour, certain characters which have been used to distinguish subspecies prove to be entirely inconstant. This is notably the case with the black line which in many specimens runs along the side of the body and along the forearms,



forming a very conspicuous mark, while in other specimens from the same localities this line is reduced, broken or altogether absent. On this account Thomas's *C. haringtoni solutus* must be considered a synonym of true *haringtoni*.

On the other hand the characters that are of use are the general colour of the upper surface, the extent of the facial light mask, whose actual colour is of less constancy, and the general coloration of the tail. Even these are, of course, variable to a certain extent, but the series we have been privileged to examine shows a sufficient average constancy in them to justify our using them for subspecific distinction.

The following are the collecting stations at which these squirrels were obtained, with their approximate distance from Hkamti southwards in miles, following roughly the course of the river, but not its smaller windings:—

Hkamti	...	...	...	26°-5' N. 95°-55' E.
Kauktaung	...	...	...	25 miles S. of Hkamti.
Minsin	...	...	...	50     "     "
Tamanthe	...	...	...	65     "     "
Maungkan	...	...	...	85     "     "
Homalin	...	...	...	105   "     "
Pyauingbyin	...	...	...	140   "     "
Kindat	...	...	...	180   "     "
Yin	...	...	...	250   "     "

The range in altitude is not great, only some 300 feet in all.

Of these nine stations only two do not have a peculiar form of *C. sladeni*, Kauktaung having one practically the same as that of Minsin, while those of Maungkan and Homalin are also quite the same. We therefore get from Hkamti to Kindat a definably different form on the average every thirty miles, a longer distance (70 miles) separating the seventh subspecies at Yin from that of Kindat.

How far this remarkable plasticity compares with that of other mammals elsewhere we have no material to judge, but a reference may be made to the *Traguli* of the Rhio Linga Archipelago worked out by Mr. G. S. Miller.\* There, while the great areas of Sumatra and the Malay Peninsula only have one form of a certain type, the little Archipelago, about a hundred and fiftieth of their extent, has developed seven, but the problem of their causation is affected by insularity, while the squirrels of the Chindwin have evolutionized in a continuous land area.

To what distance eastwards from the river the different subspecies range remains to be proved. Some at least extend to the Irrawaddy, but whether down the west side of that river the whole seven will again be found we can at present express no opinion.

\* Proc. U. S. National Mus. 37, p. 1. pts. 1-3, 1909.

The following are brief descriptions of the seven Chindwin subspecies we recognise, passing from north to south :—

1. *Callosciurus sladeni shortridgei*, subsp. n.

(See plate fig. 1.)

General colour above grizzled “cinnamon-brown” or “Dresden brown.” Light facial mask small, rarely extending beyond eyes and sometimes almost absent. Feet and under surface buffy or ochraceous. Tail like the body, but more coarsely grizzled for four-fifths its length, the end ferruginous, commonly bleached to yellowish at the extreme tip. A faint demarcational line rarely present. No light hip patch.

Dimensions of the type, measured in the flesh :—Head and body, 235 ; tail, 262 ; hindfoot, 54 ; ear, 23. Greatest length of skull :—56·4.

*Habitat*.—Hkamti, Upper Chindwin. Alt. 500'.

*Type*.—Adult female. B. M. No. 15.5.5.104. Original number 5,863. Collected 28th July 1914. 43 specimens examined. One only coloured like the next subspecies.

We have named this fine squirrel, the terminal discovery of his expedition up to the Chindwin, in honour of Mr. Shortridge himself, in token of his enthusiastic interest in the subject, which has resulted in the collection of the magnificent series before us.

2. *Callosciurus sladeni fryanus*, subsp. n.

(See plate fig. 2.)

General colour above more buffy than the last, approaching “tawny-olive,” grizzle with black. Under surface varying from buffy to ochraceous. Feet and mask very light, pale buffy or whitish, the mask extending on to the forehead. Proximal three-fourths of the tail like body, the end ochraceous or buffy—less rufous than in *shortridgei*. A whitish or pale buffy patch outside hips, as in members of the *lokroides* group.

Dimensions of type :—Head and body, 238 ; tail, 273 ; hindfoot, 56 ; ear, 22. Skull length, 56·3.

*Habitat*.—Minsin, Upper Chindwin. Alt. 450'.

*Type*.—Adult female. B. M. No. 15.5.5.117. Original number 6,055. Collected 14th August 1914. Seven specimens quite typical in colour, and an eighth more like *C. s. careyi*.

Of three specimens from Kaukaung, half-way towards Hkamti, two agree best with this form, while the third is more like *shortridgei*.

Named after Mr. T. B. Fry, to whom both Miss Ryley and we ourselves have been indebted during the last three years for an immense amount of clerical help in sorting and labelling the material obtained during the Bombay Society's Survey.



*Callosciurus sladeni shorthidgei*



*Callosciurus sladeni fryanus* ♀



*Callosciurus sladeni areos*



*Callosciurus sladeni harringtoni* ♀



*Callosciurus sladeni millardi* ♂



*Callosciurus sladeni sladeni* ♀



*Callosciurus sladeni rubex* ♀

Nat. Size.

SEVEN DIFFERENT FORMS OF SQUIRREL FOUND IN THE CHINDWIN VALLEY.

3. *Callosciurus sladeni careyi*, subsp. n.

(See plate fig. 3.)

General colour buffy or ochraceous, almost or quite without black grizzling. Undersurface buff. Hands, feet and mask paler buff the latter extending well up on to the crown. Tail from close to its base coloured like the back, nearly uniform ochraceous, with comparatively few and inconspicuous blackish rings on the hairs, the extreme tip paler and more buffy. An indistinct lighter hippatch present.

Dimensions of the type:—Head and body 254 mm.; tail, 284; hindfoot, 56; ear, 23. Skull:—Length, 57.7.

*Habitat*.—Tamanthe, Upper Chindwin. Alt. 430'.

*Type*.—Adult female. B. M. No. 15.5.5.121. Original number 6,065. Collected 16th August 1914.

This form is characterised by its ochraceous colour, without grizzling, the absence of grizzling and the almost wholly light tail separating it from the previous subspecies, while its stronger and more ochraceous tone distinguishes it from the nearly white *haringtoni*.

Named in honour of Mr. B. S. Carey, C.S.I., C.I.E., Commissioner of the Division, to whose assistance Mr. Shortridge has been greatly indebted during the whole of his work.

4. *Callosciurus sladeni haringtoni*, Thos.*Sciurus haringtoni*, Thos.*Sciurus haringtoni solutus*, Thos.

(See plate fig. 4.)

General colour varying from buffy to nearly white, without black grizzling. Undersurface buffy or ochraceous; black demarcational line present or absent. Mask buffy or whitish, extending well up on to the crown. Hands and feet buffy. Tail pale buffy or white, without annulations on the hairs. A pale hip patch visible whenever the general colour is dark enough to show it.

Dimensions of an adult female:—Head and body, 260 mm.; tail, 271; hindfoot, 56; ear, 22.

*Habitat*.—Moungkan 420' and Homalin 400', Upper Chindwin. 47 specimens in the present collection, besides the two original examples obtained by Major Harington.

Thus far, passing southwards, the body colour of these squirrels has been getting lighter and lighter, but now, with the passage of the river Uyu, the largest Eastern tributary of the Chindwin, an abrupt change takes place, the body becoming quite dark, though the mask, feet and tail remain light.

5. *Callosciurus sladeni millardi*, subsp. n.

(See plate fig. 5.)

General colour above dark grizzled grey, the light rings on the hairs buffy. Undersurface rich buffy, a black demarcational line

present. Mask (which extends to crown), hands and feet creamy white. No light hip patch. Tail with its basal fourth like the body, the remainder uniform ochraceous or buffy, the ochraceous examples becoming paler and more buffy terminally.

Dimensions of the type:—Head and body, 247 mm.; tail, 254; hindfoot, 55; ear, 23. Skull:—Length, 58.

*Habitat*.—Pyaungbyin, 40 mi. N. of Kindat, Upper Chindwin.

*Type*.—Adult male. B. M. No. 15.5.5.136. Original number 5,484. Collected 21st June 1914. Seven specimens.

This subspecies resembles *haringtoni* in the buffy or whitish colour of its face, feet, and tail, though the last tends to be more ochraceous, but is distinguished by its dark grey instead of whitish general body colour.

With this handsome and conspicuous squirrel we have much pleasure in associating the name of our friend Mr. W. S. Millard, Honorary Secretary of the Bombay Natural History Society, to whose energy and generosity the success of the Society's Mammal Survey is mainly due.

6. *Callosciurus sladeni sladeni*, Anders.

(See plate fig. 6.)

General colour above grizzled olive grey, about as in *millardi*. Undersurface deep ochraceous or ferruginous. Feet and mask ochraceous, rarely buffy, the mask extending well up on to the crown. Demarcational line present or absent. Proximal three-fourths of tail grizzled like back, the tip ferruginous.

*Habitat*.—(On Chindwin) Kindat, 250'. Type of *bartoni* from the Uyu River.

The 40 Kindat specimens are very uniform in colour, mostly quite like true *sladeni*, but in one the mask is buffy, as in *C. s. bartoni*. Further material from other localities will be needed before we can express a definite opinion about the last-named form.

7. *Callosciurus sladeni rubex*, Thos.

(See plate fig. 7.)

General colour above dark grizzled olive grey, washed on the back with rich ferruginous, which very commonly extends to cover the whole dorsal surface, and in one case the sides as well, so that the whole animal is then uniformly red. Muzzle, feet, and end of tail rich ferruginous.

*Habitat*.—(On Chindwin.) Yin, 70 miles below Kindat. (24 specimens.)

The Yin series presents great variation in the extent of the rufous on the body, one specimen being almost without it while another is practically wholly rufous, and thus resembles the Siamese *S. cinnamomeus*. A trace of difference between the upper and lower surfaces is however always perceptible, which is not the case with *cinnamomeus*.

*Tomeutes pygerythrus janetta*, Thos.

Sixteen from Yin and two from Monywa, both on the east bank of the Chindwin.

Passing now to a very different group of Squirrels, we find some interesting points in distribution, even where the species have already been described.

The present form, which was described from Mandalay, is found on the east bank of the Chindwin up to Yin, not penetrating at all to the west, nor further northwards than that place, no squirrel of this type therefore occurring till north of the Uyu at Homalin there is a slight eastern irruption of the next species, and again much further on at Kauktaung and Hkamti; where there is the form of *T. similis* described below. Southwards *T. p. janetta* ranges to Mt. Popa and Pyawbwe, and a certain distance up the Irrawaddy above Mandalay.

We thus find that while the north and south line of the Chindwin and Lower Irrawaddy is an absolute barrier to the extension of this Squirrel westwards, the Upper Irrawaddy, above the junction, is no such barrier, the species occurring indiscriminately on both sides.

The cause of this difference probably depends on the greater frequency or accessibility of temporary islands, joined sometimes to one side and sometimes to the other, in the Irrawaddy as compared to the Chindwin, although Mr. Shortridge states that such islands occasionally occur also in the latter river. But the very marked way in which throughout the fine series of Squirrels in the present collection the species of the East and West banks of the Chindwin are different from each other makes it difficult to believe that such island pontoons can be readily utilized for crossing the river. Mr. Shortridge himself believes that the more rapid current of the Chindwin breaks up the islands more quickly than in the Irrawaddy.

All these specimens, like the original ones, have a whitish hip-patch, while none is present in most of our skins of true *pygerythrus*, from Lower Burma. But we have come to the conclusion that this difference is wholly one of season, and that in all the present group of squirrels no thigh-patch is present during the winter months—say, from December to March—while July and August specimens always have them. This seasonal variation would explain the differences observed in several other cases, notably in the complicated problem presented by the Himalayan forms *T. lokroides* and *similis*.

*Tomeutes lokroides*, Hodgs.

Squirrels representing this long known Nepalese and Sikkim species occur all down the west bank of the Chindwin, from Hkamti to Kin, only just trespassing across the river in one place, at Homalin. This place we may note is in the area where no east-bank species of the group occurs, *T. similis* being some way

to the north, and *T. pygerythrus janetta* to the south of this point. Once across therefore there would be no competition to restrain its establishing itself on the eastern bank.

As usual we find the Lower Chindwin form of *lokroides* different from the Upper, the former being *T. l. mearsi*, Bonh., with type locality Chinbyit, not very far from Kin, while the latter does not at present appear to be separable from true *T. lokroides*. But about this we shall know more when the Society's Survey collections from Sikkim arrive.

Judged by the present fine series *T. l. mearsi* is distinguishable from true *lokroides* by the more buffy suffusion of its back, and by the whitish hip-patch being bordered above by a more or less prominently ochraceous area, which may pass right across the lower back. It is true that the ochraceous coloration does not occur in the type series (4 specimens), but these were all collected in the winter, and do not show the hip-patch at all. In the specimens of true *lokroides* the general colour of the hips is dark grizzled greyish, with which the whitish hip-patch abruptly contrasts.

The collection in all contains 53 examples of *T. lokroides*, and 36 of *T. lokroides mearsi*.

*Tomeutes similis owensi*, subsp. n.

*Tomeutes similis*, Gray, from Nepal and Sikkim, has not usually been recognized as distinct from *T. lokroides*, its characteristic ochraceous hips having been ascribed in the usual casual way to "variation" in the latter species. But, on such material as now exists, we think that Gray was right in separating them. The hip-patch of *T. lokroides*, is white or whitish, that of *similis* ferruginous. In specimens without hip-patch (presumably killed in winter) we are not as yet able to point out any distinguishing marks.

On the East bank of the Upper Chindwin our collectors obtained six specimens agreeing with *T. similis* in having ferruginous hip-patches but differing in other characters, as follows.

General ground colour above essentially of the same dark grizzled olive grey as in true *similis*, but the whole back strongly suffused with deep rufous, becoming stronger posteriorly, the loins practically grizzled "chestnut", passing without contrast into the ferruginous of the hip-patch. Head, neck and shoulders grey. Undersurface buffy, a more or less distinct grizzled greyish line running down the centre from the throat to the belly; a small central patch in inguinal region whitish. Inner side of forearms whitish, of legs strong buffy. Hands and feet grizzled grey, with or without buffy intermixture. Tail coarsely grizzled grey with but slight buffy suffusion; the terminal hairs black.

Dimensions of the type:—Head and body, 216 mm.; tail, 202; hindfoot, 46; ear, 23. Skull:—Length, 51·5.

*Habitat*.—Upper Chindwin, east bank; type from Minsin, 450'. Other specimens from Hkamti and Kauktaung. Six specimens in all.

Adult female. B. M. No. 15.5.5.189. Original number 6,060. Collected 15th August 1914.

True *T. similis* is grizzled the whole way down the back, and does not appear to have a mesial grey abdominal stripe.

This striking squirrel, the representative in Burma of the little known *T. similis* of Nepal and Sikkim, we have named after Major F. C. Owens, Deputy Commissioner of Sagaing, to whom Mr. Shortridge has been indebted for help, and who has also contributed to the Survey a number of specimens from districts which our collectors were unable to visit.

*Tomeutes stevensi*, Thos.

One female from South of Hukung Valley, 20 mi. N. of Hkamti, Upper Chindwin. Alt. 530'.

This specimen has a dark buffy hip-patch, while none is present in the other examples in the Museum. They are however—when dated—all winter specimens, while this one was killed in July.

*Dremomys rufigenis adamsoni*, Thos.

Eight from Kindat, 250'. East bank.

These specimens agree closely with the type, which was collected at Maymyo, just east of Mandalay, the Irrawaddy being here again no barrier to the distribution of the species, while the Chindwin separates *D. rufigenis* from *D. macmillani*, described below.

From the extreme Upper Chindwin however, still on the East bank, the representatives of this species form a special race, as follows:—

*Dremomys rufigenis opimus*, subsp. n.

Like *D. r. adamsoni* in its general characteristics, but darker and richer in colour throughout.

Size slightly larger than in *adamsoni*. General colour of back more suffused with rufous, not such a clear olive grey. Posterior back and hips suffused with ferruginous instead of the lighter and more buffy suffusion of *adamsoni*. Muzzle deep ferruginous, this colour extending well up to the forehead; crown mixed ferruginous and black, as compared with the grey crown of *adamsoni*. Postauricular patch white, much larger and more conspicuous than in the allied form.

Skull somewhat larger than in *adamsoni*, but of about the same shape.

Dimensions of the type:—Head and body, 210 mm.; tail, 174; hindfoot, 50; ear, 21. Skull:—Greatest length, 55.

*Habitat*.—Hkamti, Upper Chindwin, East bank. Alt. 500'.



*Type*.—Adult male. B.M. No. 15.5.5.195. Original number 5,817. Collected 25th July 1914. Five specimens.

*Dremomys macmillani*, sp. n.

A black median dorsal stripe. No rufous on cheeks or along underside of tail.

Size about as in *D. lokriah*. General colour above dark coarsely grizzled olive-grey, clearer on fore-back, suffused with dull tawny on crown, nape, and hind-back; a distinct narrow black median line present on the clearer grey part from the back of the nape to the loins. Flanks grizzled olive grey. Undersurface bright buffy, lighter anteriorly and on the inner side of the fore-limbs, darkening to cinnamon buff on the inner side of the hind limbs. The hairs with little or no slaty at their bases. A tendency to the presence of irregular white patches or lines on the centre of the chest. Anal region and base of tail beneath rich ochraceous-rufous. Cheeks like face, not rufous. Postauricular patches prominent, deep ochraceous buffy. Hands and feet mixed grey and buffy. Tail hairs ringed with black and pale buffy, their tips white; no rufous band extending along the underside of the tail, as in some species; tip of tail not specially blackened.

Skull about like that of *D. lokriah*, except that the base of the muzzle is a little broader, so that the re-entrant angle on each side is a little less marked.

Dimensions of the type:—Head and body, 180 mm.; tail, 156; hindfoot, 46; ear, 20.

Skull: greatest length, 50.3; condylo-incisive length, 44.8; zygomatic breadth, 27.7; nasals, 15.5; interorbital breadth, 14.8; palatilar length, 21; upper tooth series exclusive of p.<sup>3</sup> 8.3.

*Habitat*.—Upper Chindwin and Manipur. Type from Tatkon, on West bank of Chindwin near Kindat. Another specimen from Let Syaw, near Kabaw Valley, alt. 3,000'; and a third from Tsibet, East Manipur, 5,000'.

*Type*.—Adult male. B.M. No. 15.5.5.198. Original number 5,537. Collected 27th June 1914.

In the synopsis of the species of *Dremomys* that Thomas published in the Journal some years ago\* this most distinct squirrel would come next to *D. lokriah*, with which it agrees in the characters there referred to. But it is readily distinguishable by its distinct dorsal black line, its greyer general colour, the more completely buffy hairs of the underside, and by the greater prominence and buffy colour of the postauricular patches.

We have connected with this species the name of the late Capt. S. A. Macmillan, who accompanied and assisted Mr. Shortridge on his Chindwin trip. At the conclusion of that trip both men

\* Journ. Bomb. N. H. Soc. xviii, p. 249, 1908.

volunteered for service at the front, and received commissions. Capt. Macmillan was wounded while leading his company into action and died of his wounds on the 9th May 1915. His death will be a great loss to the Survey.

*Tamias maclellandii*, Horsf.

19 specimens referable to *T. maclellandii* were obtained during the Chindwin expedition.

Of these, 16, collected down the East bank of the river from Hkamti to Homalin, may be provisionally referred to true *maclellandii*, while the other three, from the Chin Hills, appear to represent *T. m. manipurensis*, Bonh.

Further study of both forms however is needed, both with regard to their geographical range and seasonal variation, on which latter point material is sadly lacking.

Persons living in the areas where these beautiful little squirrels are found would do a great service by collecting series of them all round the year—say, two every month—so that a thoroughly sound idea could be gained as to the seasonal changes they undergo.

B.—NOTES ON THE GENUS *CREMNUMYS*.

BY OLDFIELD THOMAS.

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The Rock-rats of the genus *Cremnomys* afford a striking instance of the increase of our knowledge and material due to the work of the Bombay Survey. None of these Rock-rats had ever been obtained at all by any Indian naturalist until the survey collector Mr. Crump got a small series in Cutch in 1911, on which Mr. Wroughton described the genus.

Now, there are available for examination no less than 238 specimens, representing, each with fair series, eight localities, from Cutch and Kathiawar in the North-west, Hazaribagh in the North-east, to Bellary and Seringapatam in the South, a range which makes it most astonishing that no *Cremnomys* had been found before 1911. The explanation is no doubt that these rats can only be obtained by systematic trapping, and so do not fall into the hands of the casual naturalist, who trusts to his gun and to natives for what mammals he gets. *Cremnomys* cannot be dug out, owing to the rocky nature of their habitat and so are never captured by natives.

Inhabiting as they do groups of rocky hills more or less isolated from each other, it is natural to find a certain amount of local difference between the specimens from different localities, and I have therefore now divided the series into three species, and these